SiliconGraphics
Computer Systems

Onyx™ Family
Product Guide

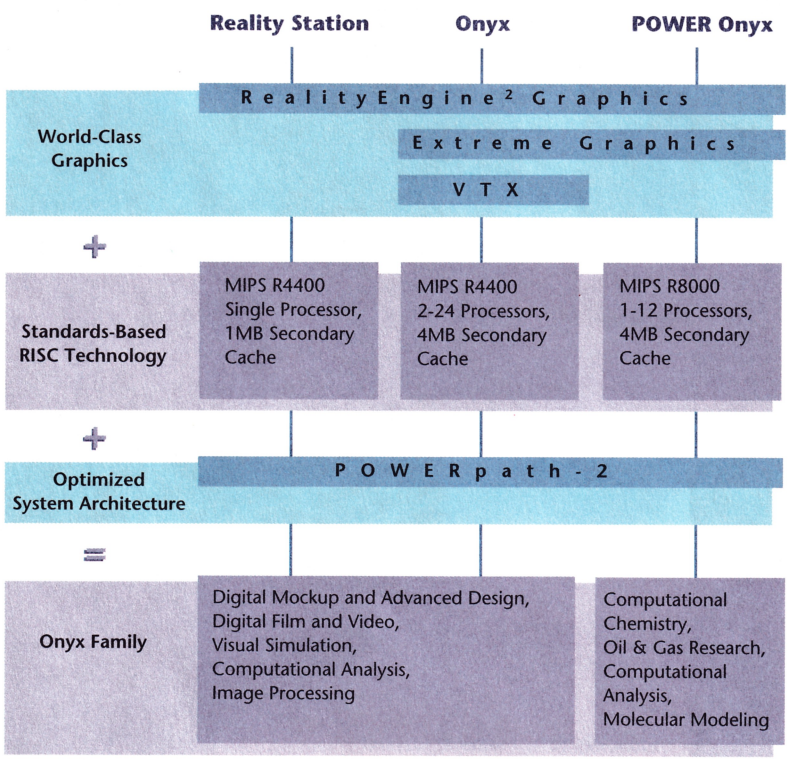
The World's Most Advanced Open Computing Platform

Today's advanced graphics applications require a level of processing power and graphics performance that few computing systems can provide. In this rarefied world, only one product line includes both the world's most powerful and the world's most affordable high-end graphics solution—the Onyx™ family of graphics computing systems from Silicon Graphics.

From the affordably priced Reality Station™ to the POWER Onyx™ supercomputing graphics system, the Onyx family offers the fastest system architecture available on the market in a full range of open-architecture, scalable solutions. UNIX®-based and binary compatible with all Silicon Graphics® systems, Onyx products also provide the flexibility you need for today's dynamic client-server environments.

Reality Station

As the most affordable platform for RealityEngine²™ graphics, Reality Station is a breakthrough in price and performance for the small organization or individual user. The perfect system for those who are seeking the ultimate in graphics, but whose needs don't include a multiprocessor environment, Reality Station combines the performance of Onyx architecture and RealityEngine² graphics in a single-CPU configuration. Scientists, engineers, and creative professionals can now have the graphics they've always wanted at a price they can afford.



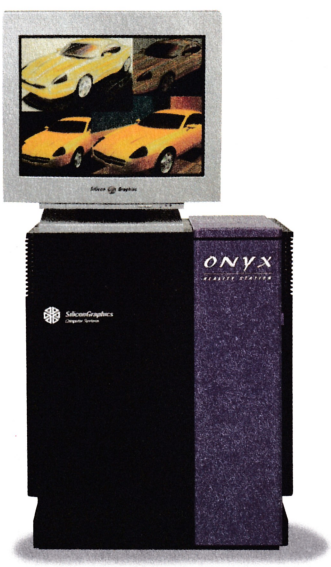


Image Courtesy of Evans & Sutherland, Conceptual Design and Rendering Software (CDRS)

Reality Station

- **Powerful Processor** - single MIPS® R4400™
- **The Ultimate in Graphics** - RealityEngine² graphics expandable to four Raster Managers
- **Massive Memory Capacity** - memory expandable from 64MB to 2GB with 2-way interleaving
- **Flexible I/O Subsystem** - one POWER Channel™-2 I/O board delivers high-performance disk, VME, and networking throughput
- **Multiple VME Buses** - three VME™ slots with 50MB/sec bandwidth per bus
- **SCSI-2 Fast/Wide Disk Technology** - up to 30GB internal disk storage, expandable to 516GB

Onyx

Onyx, the centerpiece of the Onyx family product line, brings the power of symmetric multiprocessing to the world's most advanced graphics architecture. Designed with a flexible and scalable open systems approach, Onyx can be configured with up to 24 RISC processors for supercomputing performance in a UNIX-based environment. Onyx is an ideal platform for graphics applications such as visual simulation, film and video, and virtual reality environments.

Image Courtesy of European Space Agency

Onyx

- **Multiprocessing Muscle** - two to 24 MIPS R4400 CPUs, each containing 4MB secondary cache; deskside chassis scales from two to four CPUs; rack chassis scales from two to 24 CPUs
- **Breadth of Graphics** - Onyx deskside available with Extreme™, VTX™, or RealityEngine^2; Onyx rack is available with VTX or RealityEngine^2 and can be scaled to support up to three RealityEngine^2 subsystems in a single chassis
- **High-Capacity Memory** - expandable from 64MB to 2GB with 8-way interleaving
- **High-Bandwidth I/O Subsystem** - one to four POWER Channel-2 I/O boards deliver high-performance disk, VME, and networking throughput

POWER Onyx

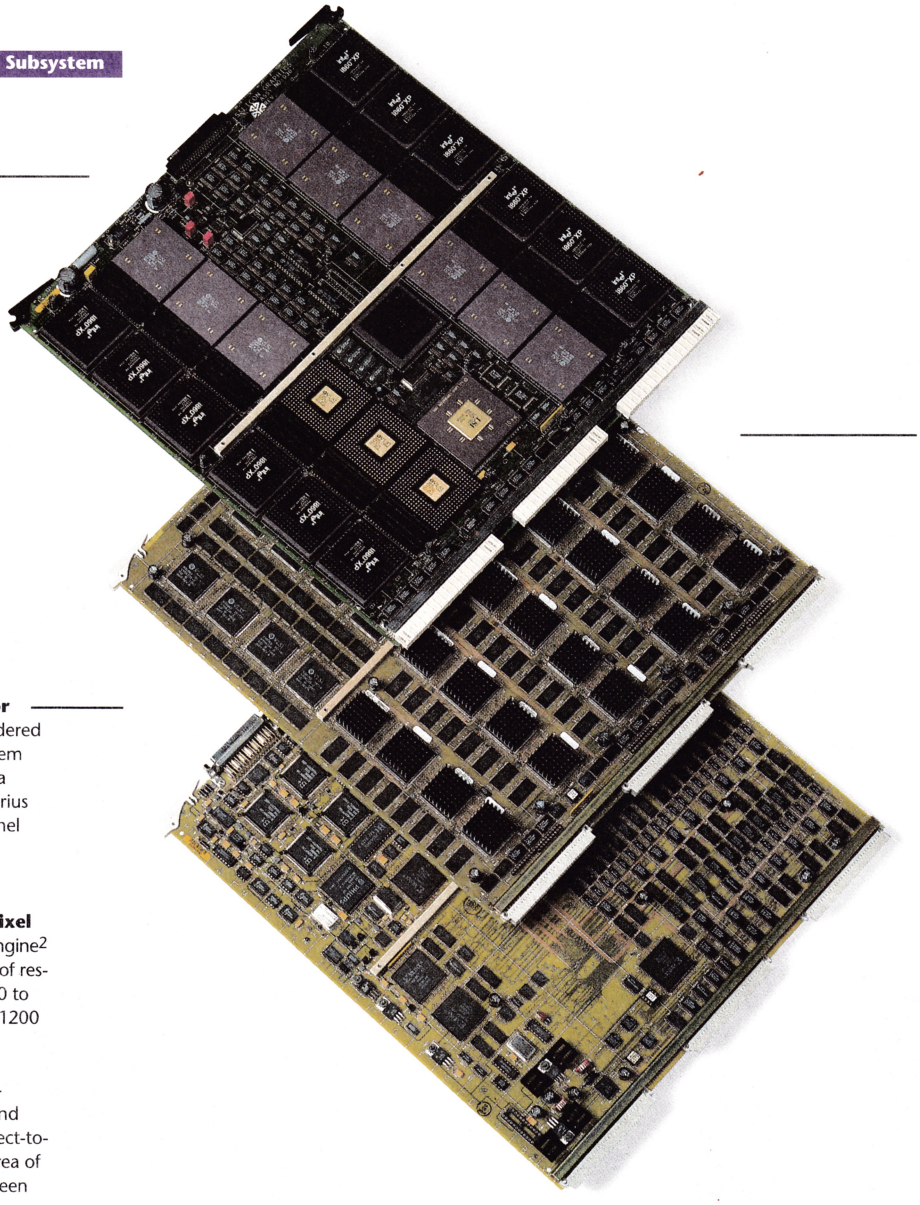
POWER Onyx introduces a new generation of RISC processor—the MIPS R8000™ CPU—to the Onyx family product line. With Onyx architecture and the astonishing floating point performance of the R8000 CPU, POWER Onyx is the world's most powerful supercomputing graphics system. For applications that require the highest possible level of floating point performance, POWER Onyx is in a league of its own.

Image Courtesy of Dr. Laurence A. Feldman, Creative Visual Software, Inc.

POWER Onyx

- **Multiprocessing Muscle** - one to 12 MIPS R8000 processors with 4MB secondary cache
- **Breadth of Graphics** - Onyx deskside available with Extreme, or RealityEngine^2; Onyx rack is available with RealityEngine^2 and can be scaled to support up to three RealityEngine^2 subsystems in a single chassis
- **Massive Memory Capacity** - memory expandable from 64MB to 16GB with 8-way interleaving
- **High-Bandwidth I/O Subsystem** - one to four POWER Channel-2 I/O boards enable high performance disk, VME, and networking throughput

RealityEngine² Graphics Subsystem

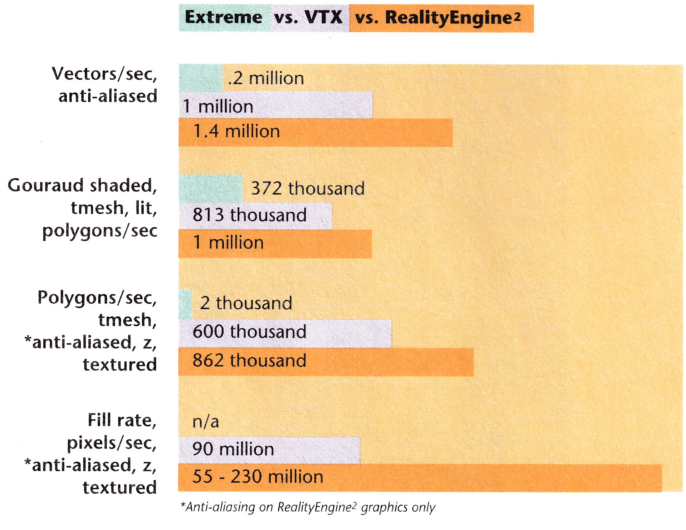


- **Geometry Engine®** - the heart of the RealityEngine² graphics subsystem
- **12 Geometry Engine processors per RealityEngine² Pipeline** - deliver 1.2 GFLOPS of processing power; RealityEngine² can render 1.5M triangles per second
- **Display Generator Board** - takes the rendered frames and outputs them as analog video, or as a digital stream to the Sirius Video™ or Multi-Channel Option boards
- **Programmable Pixel Clock** - allows RealityEngine² to drive a wide variety of resolutions, from 640x480 to 1920x1035 and 1600x1200
- **Built-In Encoder** - provides NTSC, PAL, and S-video outputs for direct-to-VCR recording of an area of the high-resolution screen
- **Raster Manager (RM) Board** - provides the pixel-fill capabilities for the system; RealityEngine² supports up to four RM boards per graphics pipeline
- **4MB or 16MB of Texture Memory** - available for all VTX and RealityEngine² systems
- **40MB Frame Buffer per RM** - four RM boards allow for multisample anti-aliasing on screen resolutions up to 1600x1200; four RMs provide an overall frame buffer size of up to 2560x2048 and 1024 bits per pixel
- **Fast Fill Rate** - 80 million pixels per second, expandable to 320 million pixels per second through the use of four RM boards

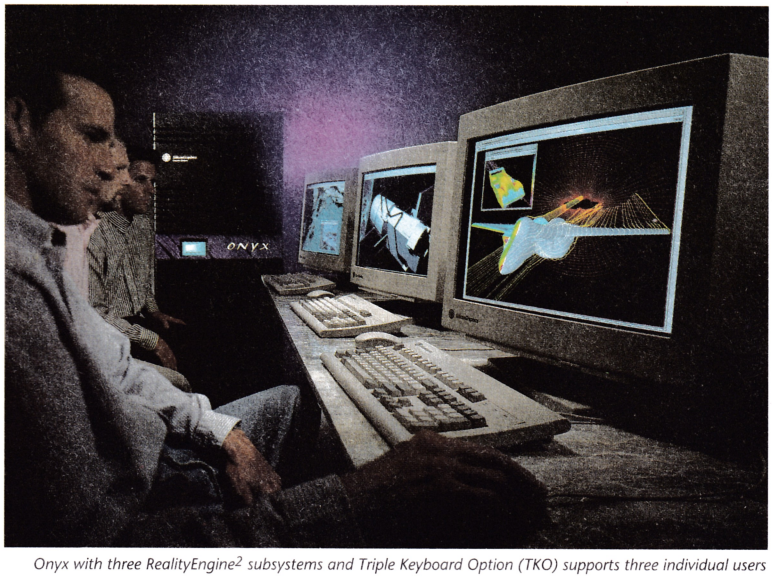
Breadth of Graphics

A choice of several graphics subsystems is available for the Onyx family. Each offers unparalleled performance in its price range and the breakthrough technology on which Silicon Graphics built its reputation.

Extreme Graphics is an excellent general-purpose visualization subsystem for users primarily concerned with processing performance. For increased capability and performance, VTX delivers over twice the performance of Extreme and includes an advanced feature set. For the ultimate in graphics performance, users can turn to RealityEngine², a scalable subsystem that provides the highest performance and most advanced features of any computer graphics system available today.



*Anti-aliasing on RealityEngine² graphics only



Onyx with three RealityEngine² subsystems and Triple Keyboard Option (TKO) supports three individual users

RealityEngine² : Interactive Realism for Reality and Beyond

RealityEngine², the most powerful graphics subsystem from Silicon Graphics, creates new possibilities for affordable image generation and simulation, digital film and video production, virtual reality, and scientific visualization.

The RealityEngine² architecture has the industry's fastest polygon, pixel, and vector performance—over 2.8 million shaded points, and 1.5 million lines and polygons per second—with pixel fill rates that can be scaled to 320 million textured pixels per second. The texturing and anti-aliasing capabilities of RealityEngine² produce the highest possible level of realism available in computer graphics.

To facilitate high-quality textured imagery, RealityEngine² is available with either 4MB or 16MB of texture memory, and supports both trilinear MIP mapping and bicubic texture filtering. Additional Raster Manager boards (up to four) can also be installed in the RealityEngine² subsystem for larger volumetric images, higher resolutions, and faster fill rates. Up to three complete RealityEngine² subsystems can be installed in a single Onyx or POWER Onyx rack chassis for the ultimate in graphics performance.

RealityEngine² can be made even more flexible by adding broadcast-quality video input and output options (Sirius Video) and a multiple display option (Multi-Channel Option) to the Onyx family system. A Triple Keyboard Option (TKO) allows a RealityEngine²-equipped Onyx system to support up to three graphics users, each with a separate keyboard, monitor, and mouse. Each user has access to combined processing, memory, and disk resources. In a system configured with three RealityEngine² graphics subsystems, TKO gives you the flexibility to allocate a separate graphics pipe to each of three users, or to use all three graphics subsystems on one application.

VTX: Advanced Features and Performance

VTX graphics offers superior price/performance for compute- and transform-oriented applications such as CFD, FEA, high-end CAD, and molecular modeling. VTX is also ideal for applications that require reduced-resolution anti-aliasing and RealityEngine²-level texture mapping. VTX graphics subsystems provide over one million shaded polygons and vectors per second, and 600,000 textured, meshed triangles. As with the RealityEngine² graphics subsystem, Onyx VTX has real-time, multisample anti-aliasing, advanced stereo, 96-bit color, volume rendering, and a 32-bit Z-buffer.

Extreme Graphics: Interactive Visualization

Extreme Graphics is a powerful general-purpose visualization subsystem for supercomputing-class applications that need integrated graphics, but may not require high-end graphics features such as real-time full-scene anti-aliasing or interactive texture mapping. Delivering up to 372,000 Gouraud shaded polygons per second, Extreme Graphics also features 24-bit hardware Z-buffer, advanced lighting models, alpha blending, and software support for texture mapping and anti-aliasing.

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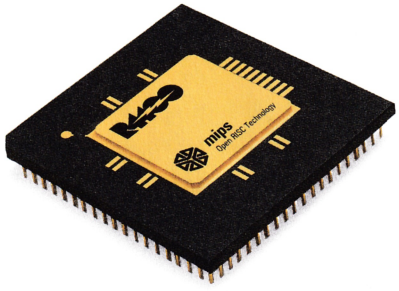
Processing Power

MIPS R4400 Processor

- **Well-Balanced Integer and Floating Point Performance** - utilized in Reality Station and Onyx
- **Large Cache for Maximum Application Throughput** - 32KB on chip primary cache; 1MB secondary cache with Reality Station; 4MB secondary cache with Onyx
- **One, Two, or Four MIPS R4400 Processors per CPU Board** - maximum of 24 processors in an Onyx rack workstation



Supercomputing Performance

Each member of the Onyx family of graphics computing systems is built around one or more 64-bit MIPS RISC microprocessors. When configured in the Onyx and POWER Onyx symmetric multiprocessing environment, these processors give users supercomputing performance at a fraction of the cost of a dedicated system.

IRIX Operating System

Silicon Graphics uses the IRIX™ operating system throughout its product line. It offers a feature-rich software environment, an extensive collection of programming tools and libraries, and built-in real-time extensions for the multiprocessing capabilities of Onyx and POWER Onyx.

IRIX is based on AT&T UNIX System V, Release 4.1., and includes numerous 4.3 BSD extensions, such as TCP/IP network protocols and Network File System (NFS), which provide transparent access to files across a heterogeneous network. Adherence to these industry standards lets users easily integrate an Onyx graphics computing system into existing computer environments.

R4400-based systems such as Reality Station and Onyx use the IRIX 5 operating system.

IRIX 6 is the first version of IRIX for the MIPS R8000 processor used in POWER Onyx systems. IRIX 6 is an upwardly compatible version of IRIX 5 which incorporates many new 64-bit features for the R8000 CPU. IRIX 6 allows 64-bit integer and logical operations, and can support up to 16GB of physical memory.

XFS

XFS is an advanced 64-bit IRIX file system that offers many exceptional features, yet is compatible with NFS and existing applications. XFS is highly scalable, supports file sizes of up to one terabyte, and delivers extremely high, guaranteed-rate I/O performance for applications such as video-on-demand. XFS is available for both IRIX 5.3 and 6.X systems.

Reality Station

Reality Station has a single R4400™ CPU with primary instruction and data caches of 16KB each as well as a 1MB secondary cache. R4400 offers a careful balance of integer and floating point performance.

Onyx

Onyx can be configured with up to 24 R4400 CPUs for a very cost-effective supercomputing, multiprocessor environment. The Onyx R4400 CPU has primary instruction and data caches of 16KB and a 4MB secondary cache.

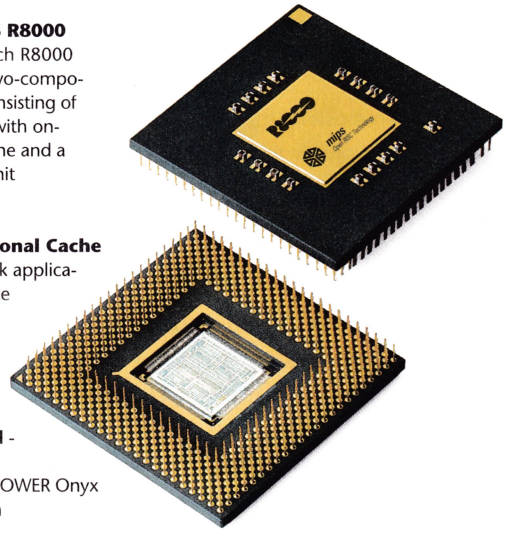
POWER Onyx

POWER Onyx uses an entirely new generation of MIPS RISC architecture, the R8000 microprocessor. Each MIPS R8000 delivers up up 360 peak MFLOPS per processor.

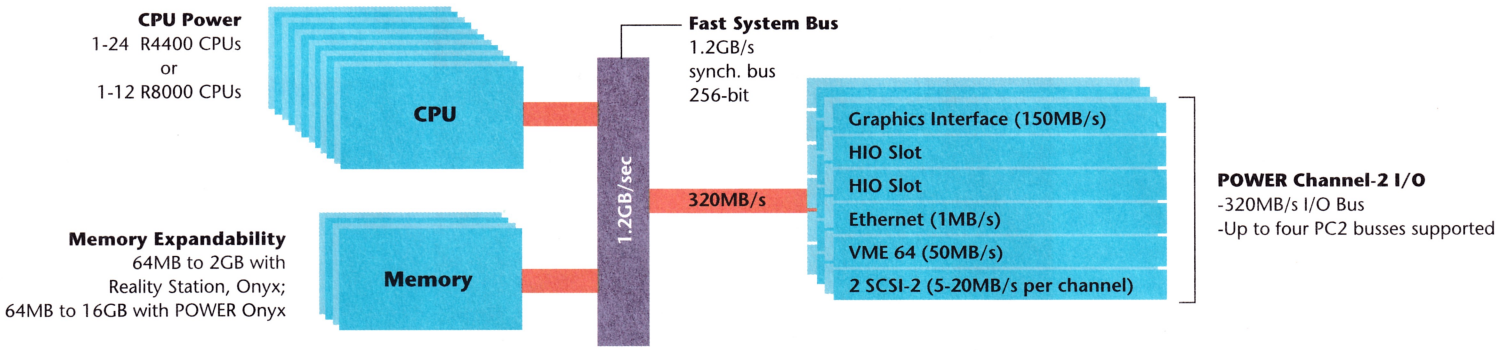
MIPS R8000 combines a large, fast-access, high-throughput cache subsystem with high-performance floating-point capabilities. It is ideal for applications with large working sets of data such as computational fluid dynamics, finite element analysis, computational chemistry, oil and gas, and image processing.

MIPS R8000 Processor

- **Optimized for Fast Floating-Point Performance** - utilized in POWER Onyx
- **64-bit MIPS R8000 Processor** - each R8000 processor is a two-component chip set consisting of an integer unit with on-board 32KB cache and a floating-point unit
- **4MB Additional Cache** - to achieve peak application performance
- **One or Two R8000 Processors per CPU Board** - maximum of 12 processors in a POWER Onyx rack workstation



POWERPath Architecture



Peak Performance and Throughput

POWERpath™ architecture, a fundamental component of every member of the Onyx family, was designed to provide benchmark-breaking throughput for these high-end graphics systems. Its primary elements are the POWERpath-2 bus, which connects each processor to both memory and I/O at an astonishing 1.2GB per second sustained transfer rate, and POWER Channel-2, the I/O component board which supports sustained I/O transfer rates of 320MB per second.

Reality Station uses a single POWER Channel-2 I/O board. Up to four boards can be used in Onyx and POWER Onyx rack systems. Each POWER Channel-2 board contains a wealth of high-speed I/O connections, including:

- A 1MB per second Ethernet™ controller
- Two 20MB per second Fast/Wide 16-bit SCSI-2 controllers (configurable as single-ended or differential)
- A 50MB per second VME64 controller
- Two 19.2KB RS232 serial ports
- A 38.4KB RS422 serial port
- A parallel port
- A 150MB per second graphics connection

Additional I/O is provided by optional SCSI-2 high-speed I/O (HIO) modules which provide three additional 20MB per second Fast/Wide SCSI-2 controllers. Each POWER Channel-2 board can be configured with up to two modules.

For high-speed networking performance, optional HiPPI, FDDI, HIO, and ATM modules can be added.

POWERpath architecture makes the Onyx family of graphics computing systems ideal for throughput-intensive applications such as satellite image acquisition and analysis, earth sciences, remote sensing, and video on demand.

Standard I/O Panel

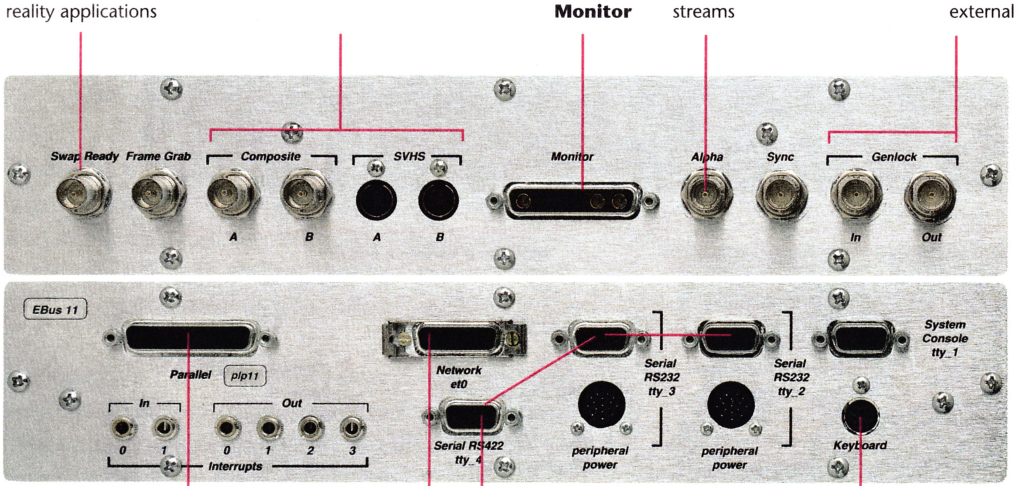
Swap-Ready - synchronizes frame rendering among multiple Onyx and POWER Onyx systems—crucial for visual simulation and virtual reality applications

Built-In Composite Video Output - allows users to easily record their work with VTX and RealityEngine^2 graphics

Monitor

Separate Alpha Channel- for blending multiple graphic streams

Built-In Genlock - allows Onyx and POWER Onyx workstations to be locked to external devices

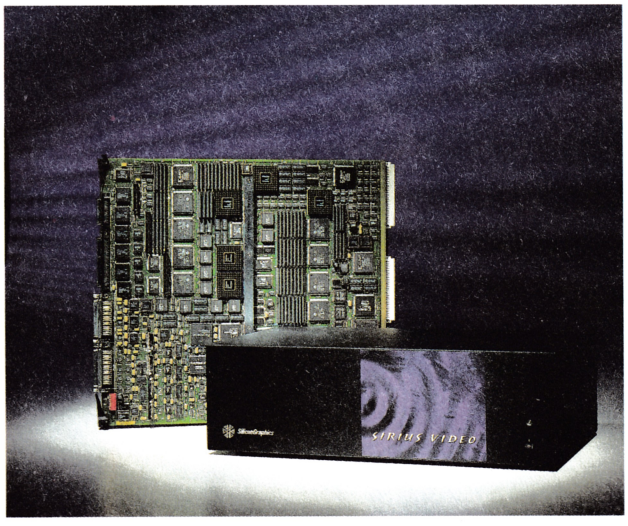


Parallel Port

Ethernet AUI

Three Serial Ports
• Two RS232 • One RS422

Keyboard/Mouse



Sirius Video Board with Breakout Box

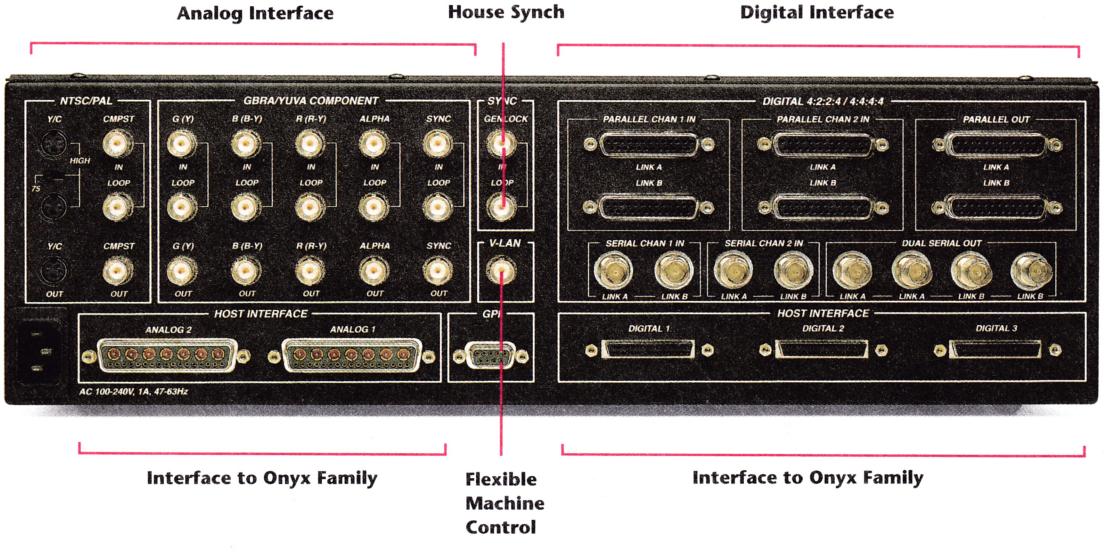
Sirius Video Option

Sirius Video gives users a single, cost-effective, general-purpose system for video production, postproduction, and broadcast and interactive television.

The combination of Sirius Video and a RealityEngine² or VTX graphics subsystem provides real-time digital video processing, computer-generated graphics, 3D geometry, image processing, and supercomputing performance—an industry first.

In addition to producing dazzling broadcast-quality video, the Sirius Video board is ideal for scientific and research applications that require full-performance video capture and manipulation. It offers application developers, scientists, and engineers unprecedented performance for digital image manipulation, data capture and record, and sequence playback. And it provides colorspace conversion and live video texture at real-time rates for advanced video applications.

Sirius Video Break-Out Box Connections



Analog Interface
- Supports both composite and component formats

Digital Interface
- Support for 8- or 10-bit devices
- CCIR 601, two inputs, one output
- Parallel and optional serial connections
- Supports full bandwidth processing up to 4:4:4:4

Flexible Machine Control
- VLAN interface
- GPI input and output lines

Deskside Onyx with Multi-Channel Option

Audio/Serial Option

The new Audio/Serial Option provides both professional-quality audio processing and high-speed serial ports on one board. The audio component allows the user to record, process, synthesize, and play four channels of 16-bit 48KHz audio signals. As an audio input source for the extensive Silicon Graphics audio library, the Audio/Serial Option is an excellent development tool for visual simulation applications. It's also ideal for film and video editors who need to process audio.

The serial component of the Audio/Serial Option has six high-performance asynchronous serial ports with very low latency for highly interactive devices such as tablets, VR equipment, or motion tracking hardware.

Audio Component Features:

- AES/EBU digital audio input and output
- Stereo line-level analog audio input and output
- Supports a wide variety of sample rates, as well as the ability to synchronize inputs to other sources

Serial Component Features:

- Six 115 Kbaud asynchronous UART ports
- Software or hardware handshaking
- TTY compatible
- RS232 and RS422 selectable by software

Multi-Channel Option (MCO)

The Multi-Channel Option gives you multiple output channels for applications such as visual simulation, entertainment, and virtual reality. Tightly coupled with VTX and RealityEngine^2 graphics subsystems, the Multi-Channel Option converts digital information stored in the graphics frame buffer into a variety of multiple analog video signals—or channels—which can then be displayed on additional monitors or projection devices.

With up to six independent channels per RealityEngine^2 graphics pipeline, the Multi-Channel Option is a cost-effective method of delivering several output channels—all from a single system.

Multi-Channel Option

Video Output Format			Multisampling Support		
			Raster Managers		
Channels	*Resolution*	*Timing*	*1*	*2*	*4*
2	640x480	60Hz non-interlaced	M	L	L
4	640x480	60Hz non-interlaced	S	M	L
6	640x480	60Hz non-interlaced	n/a	S	M
2	640x480	Field sequential RGB	n/a	L	L
2	640x486	30Hz interlaced	M	L	L
4	640x486	30Hz interlaced	S	M	L
6	640x486	30Hz interlaced	n/a	S	M
4	640x640	60Hz non-interlaced	n/a	S	M
6	745x224	60Hz non-interlaced	n/a	M	L
4	720x544	60Hz non-interlaced	n/a	S	M
3	800x600	60Hz non-interlaced	n/a	S	M
4	960x620	60Hz non-interlaced	n/a	S	M
2	960x680	60Hz non-interlaced	n/a	M	n/a
3	960x680	60Hz non-interlaced	n/a	S	M
3	850x850	60Hz non-interlaced	n/a	S	M
2	1025x768	60Hz non-interlaced	n/a	S	M
3	1025x768	60Hz non-interlaced	n/a	n/a	S
2	1200x900	72Hz non-interlaced	n/a	S	M
2	1280x1024	60Hz non-interlaced	n/a	S	M
2	1280x1024	50Hz non-interlaced	n/a	S	M

S supports small pixels for non-anti-aliased imagery
M supports medium pixels for 8 sub-sampled anti-aliasing
L supports large pixels for 16 sub-sampled anti-aliasing
n/a not supported

CyberGlove™ was provided by Virtual Technologies; Wide Eye Helmet was provided by Kaiser Electronics

A Complete Advanced Graphics Solution

The Onyx family of graphics computer systems is augmented by an array of graphics libraries and development environments. The IRIS® Development Option (IDO) includes IRIS GL™ and OpenGL™. Specialized toolkits such as Open Inventor™ simplify 3D graphics application development by automating basic programming tasks.

IRIS Performer™ and ImageVision Library®, designed specifically for 3D graphics databases and fast pixel processing, let users achieve maximum performance from the graphics hardware.

OpenGL

OpenGL is an industry-standard environment for developing 3D graphics applications on a variety of hardware platforms with different operating and window systems. OpenGL includes operators for geometric and raster primitives, and viewing and modeling transformations, as well as lighting, shading, blending, fog, hidden surface removal, texture mapping, and other graphics functions. These graphics functions are provided for every conforming OpenGL implementation, whether on a Silicon Graphics system, another vendor's workstation, or a PC. This makes applications written with OpenGL easily portable between platforms.

Performer: Image Generation Made Fast and Easy

IRIS Performer is a software development environment that provides high-level support for visual simulation, virtual reality, and graphics-intensive tasks. As an economical and productive starting point for application developers, Performer™ includes advanced image-generation functions layered above IRIS GL.

The outer layer of Performer implements functions such as culling, controlling many different display channels, and performing fast intersection tests with simulation databases. The inner core of Performer is a rendering executive designed for maximum performance. The two layers work together seamlessly in parallel, creating a flexible advanced simulation-oriented development environment.

Performer also automatically handles the control and coordination of the multiple CPUs. The result is blindingly fast graphics.

■ Performer Allows the User to Customize the Scene

- Users can adjust scene and environment variables and instantly see the results; the scene field of view, visibility range, and frame rate can be fine-tuned using slider bars provided on the user interface
- Environment variables can be changed to simulate different times of day and weather conditions

■ Level of Detail Management

- Ensures that only items which contribute significantly to the scene are rendered; if they do not, they are eliminated or reduced

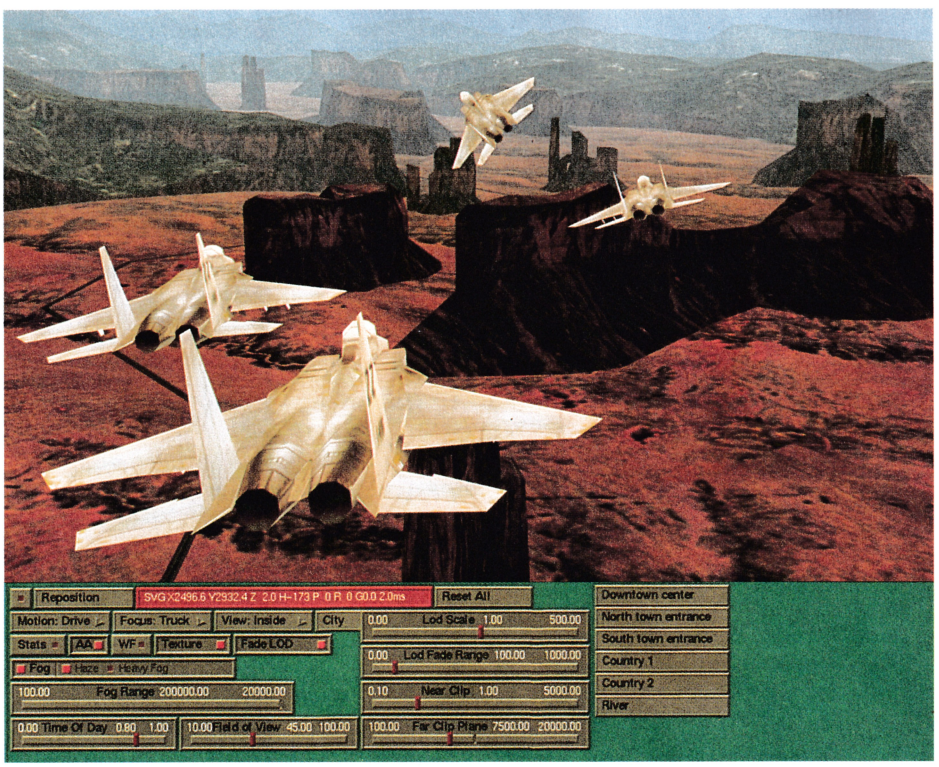


Image courtesy of Paradigm Simulation

ImageVision Library: Off-the-Shelf Image Processing

The ImageVision Library (IL) toolkit is an object-oriented extensible library for creating, processing, and displaying images. Its robust core set of image processing functions includes color conversion, arithmetic functions, radiometric and geometric transforms, statistics, spatial and non-spatial domain transforms, and edge, line, and spot detection. These functions simplify the extension of standard function sets to suit specific image processing needs.

The IL toolkit's demand-driven, page-oriented execution model is well suited to the Onyx and POWER Onyx symmetric multiprocessing architecture. ImageVision Library takes advantage of all available processors during program execution, without requiring users to make any changes in program code. In addition, Onyx RealityEngine2 offers the performance of dedicated image processing hardware in a general, commercial off-the-shelf package. The IL toolkit uses RealityEngine2 to accelerate imaging operations while maintaining compatibility across the Silicon Graphics product line.

All the Pieces in Place

The Onyx family is the only product line that offers the breakthrough pricing of Reality Station and the record-breaking performance of POWER Onyx. The Onyx family offers a unique solution to the demands of today's advanced graphics environments. It combines a flexible UNIX-based operating system and open system RISC architecture with the sound investment value of upgradable microprocessors and a vast collection of developer tools and libraries, along with power-to-grow scalability .

The Onyx family is backed by superior service and technical support. At Silicon Graphics, we've always understood that no amount of technological leadership can meet customer needs without a responsive, well-trained, worldwide service and support infrastructure. As the established leader in visual supercomputing, we give our global customer base experienced technical support. With Reality Station, Onyx, and POWER Onyx systems, Silicon Graphics continues to meet the needs of the world's most advanced graphics supercomputing application development.

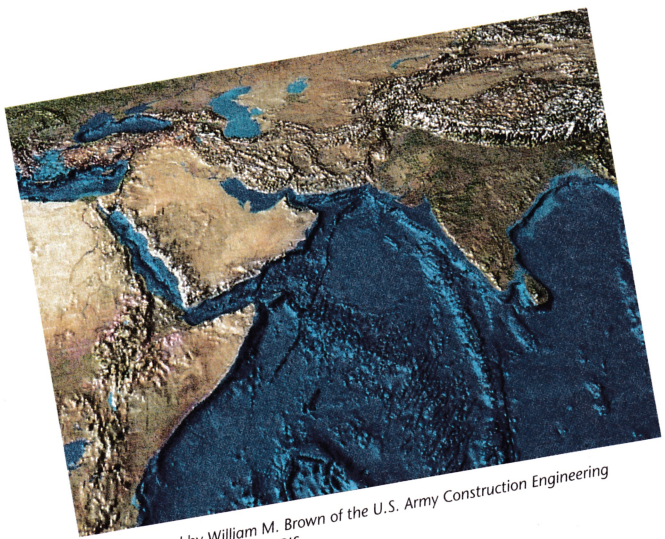


Image created by William M. Brown of the U.S. Army Construction Engineering Research Labs using GRASS GIS

For more information on how the Onyx supercomputer family can help you deliver the ultimate in advanced graphics applications, call Silicon Graphics now. Please refer to the numbers listed on the back of this brochure.

Technical Specifications

Platform:

	Reality Station™	Onyx™	POWER Onyx™
Processor Data			
Type	MIPS® R4400™ 250MHz	MIPS R4400 250MHz	MIPS R8000™ 90MHz
Quantity	1	2-24	1-12
Primary Cache	16KB instruction, 16KB data	16KB instruction, 16KB data	16KB instruction, 16KB data
Additional Cache	1MB per processor	4MB per processor	4MB per processor
SPECint92	TBD	180	132.2
SPECfp92	TBD	177	396
Peak MFLOPS	125	125	360
DP MFLOPS, Linpack1000 x1000	TBD	TBD	308
Memory	64MB to 2GB 1- or 2-way interleaving, ECC protected	64MB to 2GB 1, 2, 4, or 8-way interleaving, ECC protected	64MB to 16GB 1, 2, 4, or 8-way interleaving, ECC protected
Graphics			
RealityEngine²	deskside only	deskside and rack	deskside and rack
VTX	n/a	deskside and rack	n/a
Extreme	n/a	deskside only	deskside only
Operating System	IRIX™ 5	IRIX 5	IRIX 6

Graphics:

	Extreme™	VTX™	RealityEngine²™
Anti-aliased vectors/sec	210K	1.0M	2.0M
Triangle Meshes/sec	600K	1.0M	1.5M
T-Mesh Gouraud Z, lit	370K	813K	1.0M
T-Mesh Textured	2K	600K	988K
Quad Strips, Gouraud, Z	185K	350K	530K
Pixel Fill, smooth, Z	100M	90M	90-360M
Pixel Fill, textured, aa	n/a	n/a	55-230M
24-bit Z	yes	yes	yes
32-bit Z	software only	yes	yes
Color	24-bit RGB	48-bit RGBA	48-bit RGBA
Color Planes	56	192	192
Overlay/Underlay planes	4	8	8
Max bits/pixel	24	256	256-1024
Texture Memory	n/a	4MB	4 or 16MB
Frame Buffer Size	8MB	40MB	40 to 160MB
Display	VGA to1280x1024	VGA to1280x1024	VGA to HDTV
32-bit Pixel Read/Write	15.1M/13.6M	21.1M/26.8M	28.3M/29.1M

System Bus

Bandwidth	1.2GB/sec, parity protected
Size	256-bit wide data path
	40-bit wide physical address path

High-Speed I/O Subsystem

Bus Type	SGI HIO bus
Bandwidth	320MB/sec per HIO bus
No. of Buses	1 to 4
No. of Slots	1 to 8

Industry-Standard I/O Subsystem

Bus Type	VME64 bus
Bandwidth	50MB/sec per VME64 bus
No. of Buses	1 to 5
No. of Slots	3 to 24

Mass Storage

Interfaces	Up to 32 SCSI-2 channels
Protocols	SCSI-2, Fast/Wide, single-ended or differential
Max. Bandwidth	20MB/sec per channel
Device Capacity	2GB, and 4.3GB formatted

Removable Media

SCSI Devices	CD-ROM, DAT, 8mm tape drive, 1/4" cartridge tape

Communications

Integrated Serial I/O	Up to 12 serial ports Ethernet™, SCSI-2
Integrated Parallel I/O	Up to 4 parallel ports
VME™ Controllers	Ethernet, FDDI
SGI HIO Controllers	FDDI, HiPPI, SCSI-2, ATM, Audio/Serial Option

Dimensions & Weights

Rack Chassis		
	Dimensions	Height: 62.3" Width: 27" Depth: 48"
	Net Weight	400 lbs (181 kg)
Deskside Chassis		
	Dimensions	Height: 25.2" Width: 20.5" Depth: 32"
	Net Weight	160 lbs (72.6 kg)

Environmental (Non-Operating)

Temperature	-20 to +60 C
Humidity	10% to 95% non-condensing
Altitude	40,000 MSL

Environmental (Operating)

Temperature	+5 to +35 C
Humidity	10% to 80% non-condensing
Altitude	10,000 MSL
Noise	65dBA

Electrical & Power

Voltage	Deskside	110-230VAC 1 Phase
	Rack	208-230VAC 1 Phase
	Rack	208VAC 3 Phase U.S.
	Rack	400VAC 3 Phase Europe
Frequency	50/60 Hz	

Heat Dissipation

9,226 BTU/hr max (110-230VAC 1 Phase Deskside)
16,863 BTU/hr max (208VAC 1 Phase Rack)
25,295 BTU/hr max (208/400VAC 3 Phase Rack) W

Electrical Service and Type

Deskside	120VAC @ 20A (1 Phase) Type NEMA5-20R
Deskside	208VAC @ 20A (1 Phase) Type NEMA6-20R
Deskside	230VAC @ 16A (1 Phase) Type dependent on country
Rack	208VAC @ 30A (1 Phase) Type L6-30R
Rack	230VAC @ 32A (1 Phase) Type dependent on country
Rack*	208VAC @ 30A (3 Phase, 4 wire) Type NEMA L15-30R
Rack*	400VAC @ 32A (3 Phase, 5 wire) Type IEC 309

* With graphics or VME™ expansion cage

SiliconGraphics
Computer Systems

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